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Hamel, Jean-Yves
United Nations Development Programme

27. September 2010

Human Development
Research Paper
2010/37

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Human Development Reports
Research Paper

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Jean-Yves Hamel

Jean-Yves Hamel is Web Content Specialist at the Human Development Report Office, United Nations Development Programme. E-mail: jean-yves.hamel@undp.org

Comments should be addressed by email to the author.

Abstract

This study frames a review of information and communication technology for development (ICT4D) within the human development and capabilities approach. Looking at the basic dimensions of human development, which make up the core measurement of its achievements: health, education and a income, and additionally at the dimensions of participation and empowerment, a survey of research and evidence seeks to evaluate whether or not ICTs have demonstrated positive outcomes for these dimensions of human development and more broadly to the practice of its approach. The paper reviews the literature and research conducted in these dimensions in order to establish a sense of the scope and potential that ICTs have for human development. By doing so, the paper seeks to assess whether or not the use of ICTs is pertinent to the human development of the poor, and if so, which are documented cases and outcomes that can perhaps be replicated in differing development contexts. The paper also seeks to answer questions on the role of government policy and investment in ICTs as keys to their success in development and whether or not ICTs should be emphasized at all in poor countries. The paper concludes with the important realisation that ICTs alone cannot improve peoples' lives; the use of ICTs needs to occur within broader strategies that are tailored to make the most use of these tools and techniques in order to reap their potential benefits for human development.

Keywords: human development, information and communication technology, ICT4D, telecommunications reform, empowerment, participation.

JEL classification: D1, I0, O3, O15, Z1

Introduction

There are in the development community several schools of thought that advocate that the progress of societies is about much more than increases in wealth and growth in macroeconomic indicators. The human development and capability approach in particular sees development as a multidimensional and multidisciplinary process of enlarging people's choices and freedoms. The approach is often seen as having been launched by the Human Development Report (HDR) of the United Nations Development Programme (UNDP) but it is much broader than this series of publications. The first HDR proposed a rather simple yet resonating vision for development, “to create an enabling environment for people to enjoy long, healthy and creative lives" (UNDP, 1990: 9). This objective rings as true today as it did twenty years ago since human development brings to the forefront of the debate concerns for agency, voice and empowerment and it "draws attention to 'what makes life worthwhile': people” (Alkire and Deneulin, 2009: 25). This study frames a review of information and communication technology for development (ICT4D) within the human development and capabilities approach. Looking at the basic dimensions of human development, which make up the core measurement of its achievements: health, education and a income, and additionally at the dimensions of participation and empowerment, a survey of research and evidence demonstrates that despite major inequalities across the world and continued gaps on access and use of information and communication technologies (ICTs), these tools and techniques can have positive impacts for human development.

The paper understands ICTs as tools or techniques that allow recording, storing, using, diffusing and accessing electronic information (World Bank, 2002). This paper also accepts more broadly that ICTs are “tools that facilitate communication and the processing and transmission of information and the sharing of knowledge by electronic means” (UNDESA-GAID, 2009: 5). The

paper understands dimensions of human development as categories of achievements and choices that are essential for human life to flourish. As Alkire (2002: 186) notes, dimensions of human development are "non-hierarchical, irreducible, incommensurable and hence basic kinds of human ends" that are clear and valuable objectives for human progress that go beyond social or cultural values. Like human rights for advocates of international law, dimensions of human development are structured to represent valued outcomes that people have a reason to wish and work for. The paper focuses on health, education, and income because these are both the most commonly reported dimensions of human development and perhaps the most universally accepted. Participation and empowerment are also included because they are increasingly discussed in the development literature that seeks to push the frontiers of development thinking. They are also of particular interest to the author. As Sen (1999) established, development is fundamentally about freedom. This makes participation and empowerment two essential components of contemporary theory and research about human development.

The key questions asked by the paper are whether or not ICTs have demonstrated positive outcomes for these dimensions of human development and more broadly to the practice of its approach. By doing so, the paper seeks to assess whether or not the use of ICTs is pertinent to the human development of the poor, and if so, which are documented cases and outcomes that can perhaps be replicated in differing development contexts. If these tools and techniques can be shown to increase outcomes in health, education and income of people and if it can be furthermore demonstrated that ICTs are positively increasing peoples' participation and empowerment within their communities and society, then we will be able to say that ICTs can be good for human development. The challenge will be the measurement of the extent to which these tools and techniques can deliver results when combined to approaches to development. As

will be discussed, evidence surveyed is often anecdotal or illustrative and causalities are very often impossible to establish. Despite these caveats, the paper reviews the literature and research conducted in these dimensions in order to establish a sense of the scope and potential that ICTs have for human development. The paper also seeks to answer questions on the role of government policy and investment in ICTs as keys to their success in development and whether or not ICTs should be emphasized at all in poor countries. As with any approach to development, there are potential downsides and these will be surveyed along with examples commonly seen as success stories. All of these difficult assessments will be essential to the evolving field of ICT4D since claims that ICTs divert development funds from more pressing concerns will be justified if these technologies are not able to deliver added benefits for the poor. This point of is of immense importance to developing countries where "there inevitably are trade-offs among the competing claims of stakeholders for scarce resources for investment" (Mansell, 2009).

To achieve these objectives, the paper begins by introducing the reader to the concepts of human development and the capabilities approach while demonstrating its linkages to the field of information and communication technology for development (ICT4D) in order to consequently explain how ICTs have the potential of being capability enhancers. A survey of statistical data on the availability and use of ICTs across Human Development Index (HDI) groupings since 1990 is then presented to show progress on use of ICTs around the world but also to establish an understanding of the obstacles that exist on the ground when including ICTs in the practice of development. These reviews serve as the foundation to discuss the impacts of ICTs for the human development dimensions of participation and empowerment followed by health, education and income. Although no technology can be a panacea for development the reviews contained in the paper show that these tools and techniques can be an integral part of human

development but that their success is always tied to the particularities of each context and the design and implementation of their use within development. The paper concludes with the assertion that ICTs can enhance capabilities for human development when applied with foresight, clear objectives, a firm understanding of the obstacles that exist in each context and proper policies that establish an institutional framework that promote the use and benefits of ICTs for the poor.

ICT4D and the Human Development and Capability Approach

Human development is an evolving framework benefiting from the intellectual contributions of an extensive network of researchers around the world. The approach is born from the concerns of development practitioners and continues to evolve with new development challenges. Synthesising the various views on the approach, which are largely defined by Amartya Sen's work and by the global HDRs, we can understand that the aim of human development is: "to expand people's freedoms – the worthwhile capabilities people value – and to empower people to engage actively in development processes, on a shared planet… People are both the beneficiaries and the agents of long term, equitable human development, both as individuals and as groups." (Alkire 2010: 40). The essential components of this definition, which are of special relevance to this paper, are the idea that human development is a process that is participative and empowering. These core principles of the approach have served human development well as evident by its reception around the world. The approach is commonly seen by its advocates as today's most relevant approach to development and the embodiment of the United Nations' founding principles (Jolly et al., 2009).

In a rapidly changing world, where networked technology has not only become ubiquitous but also necessary for the governing of states and the maintenance of our global economy (Castells, 2000), how can we understand the linkages between the human development and capabilities approach and the impact that technologies can have on peoples' lives? There has been a concern within the development community as to the rapidly growing use of ICT and its relevance to development since the early 1980s when the International Telecommunications Union (ITU) undertook the first major research project on some of their linkages. The conclusions of this first major study were that ICTs and the networks linking them needed to be strengthened across the world in order to share the benefits that these technologies bring to "health and other social services, administration and commerce, but also in stimulating economic growth and enhancing the quality of life" (Maitland, 1984: 65). This field is now commonly known as information and communication technology for development (ICT4D). Twenty years later, the World Summit on the Information Society (WSIS) convened by the United Nations in 2003 and 2005 served to solidify opinions amongst government and development practitioners on the potential impacts of ICTs and their role in development (WSIS, 2005). Seen as able to deliver on both human development concerns for participation and empowerment, as well being significant to the Millennium Development Goals, ICTs are advocated to play an important role as enablers of development (UN, 2000; Rezaian, 2006), On the ground, ICT4D is essentially a framework for the application of tools and techniques to the practice of development. It is a multidisciplinary field within the practice of development that has benefited tremendously from the research, application and immense support from academia, the private sector and major development agencies (Unwin, 2009d). It can be summarised as the use of ICTs to reach development objectives but their potential impact lie in the uniqueness of these new tools, such as mobile

phones and the World Wide Web, which have revolutionised the ease with which people are able to exchange and share information across vast distances. Their potential for accumulation of searchable knowledge and information are responsible for what many are now calling the advent of the Information Age (Castells, 2000). Contrary to the physical objectives of ICTs, which are fundamentally to overcome limitations of existing techniques of information storing and sharing, ICT4D has a "profoundly moral agenda" that aims to empower people and communities by answering the difficult questions of not only "what should be done" in the practice of development but also "how we should do it" (Unwin, 2009a: 33).

Mahbub ul Haq, intellectual founder of the HDRs, wrote that achieving development and promoting choices in peoples' lives does not only mean increased levels of health and security, it also means increased access to information that leads to knowledge (Haq, 1995). Mchombu (2004) explains that the human development and capability approach therefore wants to see ICTs as tools to establish and increase access to information for marginalised groups within society, as tools that promote autonomy and participation, as means to promote and protect local knowledge and as vehicles that are complimentary to traditional channels of communication. Capabilities are what Amartya Sen dubbed "doings and beings". Essentially, they are the skills, aptitudes, endowments and potentials that individuals have to make choices in their lives, and in consequence live the life of their choosing. Capabilities are bound by freedom and represent the essence of a person's potential in life, what they can achieve under their current circumstances, whether those limitations are inherent or imposed. As Sen (2009: 5) states, "Capability reflects a person's freedom to choose between different ways of living." They are heavily influenced by the context in which the person lives and the sum of their experiences and desires. Viewed in this light, tools and technologies are an intricate part of the advancement of humanity since they can

increase our capabilities by allowing us to do more with our life, or at the very least to do different things with our life. In practice, their material possession matters much less than the potential that they extend to our lives. For example, information that is shared through technology such as ICTs can become capability enhancers, allowing people to make better judgments by virtue of having access to knowledge that was once not available to them. Sen considers this interplay between information and one's capabilities to be of immense importance. He sees knowledge as a resource that can be acted upon. It is essential to human life since "Informational limitation restricts or distorts consequential judgments" (Sen, 1984: 302). Knowledge can be liberating (Freire, 2000), which complements well the view that development is fundamentally about promoting human freedom, the freedom to choose how to use our capabilities (Sen, 2009).

Practitioners of ICT4D understand that technology itself cannot contribute to human development. What ultimately makes a difference in peoples' lives is the specific use of technology and the extent to which they help communities and individuals reach their development objectives. Ultimately, the concern is with the wider context. Problematic to this aim is that the design and import of new technologies consequently replace older or established ways of doing things. As Sen (2001) notes, policy makers and practitioners need to reflect on the appropriateness of technologies being used in development since the choices made in this area are in effect essential components of all development strategies. As new technologies displace older ways of doing things, there will inevitably be tradeoffs and hidden costs that will rarely figure amongst the analysis of ICT4D advocates. Looking at development from a macroeconomic perspective, one might be hesitant to retool a business sector and transform its business model to revolve around ICTs if it entails displacing a workforce that will no longer be

qualified and therefore earning wages in an economy that may already suffer from high unemployment rates and limited opportunities for those displaced workers. There is such a concept as appropriate technology but there is unfortunately little consensus of its meaning on the ground across the world, especially for the poor. Many studies show that ICTs and the changes that accompany them are "demonstrably disruptive" for many people in developing countries despite the wealth that they generate (Mansell, 2009: 8). However, these caveats should not discourage us from exploring the impacts that ICTs can bring to development, they remind us of the importance for proper planning and design of development strategies that reflect local needs, conditions and capabilities.

ICT Indicators: Progress since 1990

Recent years have witnessed an incredible spread of mobile phone connectivity and use around the world, especially in developing countries where land-lines are scarce (ITU, 2009b). There are now more than 4 billion mobile phone subscriptions around the world with 75 per cent of them in developing countries. Access to the Internet has also grown with more than 1.5 billion Internet users around the world as of 2008 and nearly 60 per cent of them live in developing countries (ITU, 2009c). Looking at average growth rates for ICTs we see very encouraging trends. Mobile and fixed-line telephone subscribers have increased by an average of 909.9 per cent overall for HDI ranked countries between 1990 and 2008, representing an average of 79.2 subscriptions per 100 inhabitants in 2008. The percentage of the world population now covered by mobile cellular networks is above 82 per cent for the world and above 50 per cent for low HDI countries. Internet users have grown by more than 137 per cent since 2002, representing an average of 23.7 per 100 inhabitants in 2008. Electrification rates are also impressive with 78 per cent of the

world having access to electricity including 63.2 per cent of rural areas (IEA, 2008). Globally, there is clear progress and promising potential for the use of ICTs in development.

Table 1: ICT Indicators by HDI classification

Indicator	Year	Very High HDI	High HDI	Medium HDI	Low HDI	World average
Internet users per 100 inhabitants	2008	71.5	33.0	14.7	6.0	23.7
Internet users, % growth	2002-2008	49.1	223.5	363.2	1677.9	137.0
Mobile cellular subscriptions per 100 inhabitants	2008	103.0	103.5	50.3	25.2	60.5
Mobile cellular and fixed-telephone subscriptions per 100 inhabitants	2008	151.7	129.2	64.2	26.1	79.2
Mobile and fixed-line telephone subscribers, % growth	1990-2008	259.2	1347.7	4814.4	12952.2	909.9
Population covered by mobile cellular network (%)	2007	99.2	95.7	81.8	50.7	82.4
Population covered by mobile cellular network % growth	2002-2007	3.5	18.4	135.9	72.8	52.9
Population without electricity % of total inhabitants	2008	0.0	3.5	39.9	81.2	22.0

Source: IEA, 2008; ITU 2009c and World Bank 2010.

Developed countries on average have seen continuous growth in mobile and fixed-line telephone subscriptions by a factor of 259.2 per cent between 1990 and 2008, representing 151.7 subscriptions by 100 inhabitants in 2008. This group also has near perfect mobile network coverage across their territories. Internet users in this group have increased by 49.1 per cent since

2002, now reaching 71.5 users per 100 inhabitants. For the high HDI group, we see impressive numbers with growth of 1347.7 per cent, or 129.2 subscriptions per 100 inhabitants in 2008 for mobile and fixed-line telephones. Internet is lower in this group that saw growth by a factor 223.5 per cent since 2002, totalling 33 users per 100 inhabitants in 2008. For the medium HDI countries, growth in mobile and fixed-line telephone subscriptions is at 4,814.4 per cent since 1990, representing in 2008 64.2 users per 100 inhabitants. The growth of Internet users drops substantially as compared to mobile phones for this group and represents an increase of 363.2 per cent since 2002, averaging 14.7 users per 100 inhabitants in 2008. As we can see, the numbers quickly dwindle as we consider poorer countries and the contrast is starkest when looking at those classified with low HDIs. For this group, mobile and fixed-line telephone subscriptions have grown by a higher factor than in any other HDI group with 12,952.2 per cent since 1990. This figure represents the important climb from a very low starting point, reaching in 2008 an average of 26.1 subscriptions per 100 inhabitants. The rapid spread of mobile telephony is responsible for this impressive increase in use of ICTs in the low HDI group but for Internet use, the numbers are at the lowest scale for all ICT indicators. They have grown by 1677.9 per cent since 2002, but represent an average of 6 users per 100 inhabitants. Electrification rates are also at their lowest in this group with an average of 81.2 per cent of inhabitants without access to electricity. They represent a total of 1.2 billion people of the 1.5 billion around the world who do not have access to electricity (IEA, 2008).

As we can see from the ITU (2009c) data, mobile coverage is quite high all around the world which will continue to promote its use and impact to development. Access to the Internet on the other hand continues to be low especially in Africa, Latin America, the Caribbean and the Middle East. There has been significant growth since 2002 as seen above and the upward trend is

indicative of investments made in low and middle income countries. In 2007 alone, this group of countries spent approximately 6 per cent of their GDPs, totalling nearly 800 billion USD on ICTs (Heeks, 2009). Looking at data on electrification rates for all regions, there is another clear divide that appears and has tremendous implications for human development. There are an estimated 1.5 billion people worldwide who do not have access to electricity and 85 per cent of them live in rural areas of developing countries (IEA, 2009). Unwin (2009e) remarks that it is rather difficult to make use of ICTs for development where there is no power supply, as is the case for many communities of sub-Saharan Africa where only 15 per cent of rural households have access to electricity. An important development agenda for engineers is therefore the development of "new, low-cost devices for local electricity generation; better ways to store, carry and transmit electricity; and lower power consumption by ICT devices" (Heeks, 2009: 6).

As the use of ICTs continues to grow around the world, it is expected that the technologies will become increasingly affordable for users. Looking at data from ITU (2009c), comparing connection costs for business and residential fixed-line telephones and mobile cellular telephones as a percentage of GDP per capita, we find confirmation of a predictable trend in all HDI classifications; telephone services are becoming increasingly affordable relative to incomes. Business telephone connection charges as a percentage of GDP per capita have gone down by nearly 89 per cent around the world since 1990 and by more than 32 per cent for residential fixed-lines. Mobile cellular connection charges have also been dramatically reduced by 75 per cent around the world since 2002. Prices have dropped most significantly for the very-high HDI group of countries, with connection charges averaging at 0.35, 0.24 and 0.07 per cent of GDP per capita in 2008 for business, residential and mobile cellular telephones respectively. The low HDI group in contrast pays on average above 9, 9 and 1 per cent of GDP per capita in 2008 for the

same services. The high HDI and medium HDI groups have average costs closer to the very-high HDI group with the exception of residential fixed-lines for medium HDI countries which averages at above 8 per cent of GDP per capita in 2008. Linking these prices to the level of competition within national telecommunications market we can further see that on average, countries that have monopolies on 5 or more dimensions of ICT service delivery are paying 23 per cent more overall for equivalent services. In very-high HDI countries, monopolies on ICTs represent a 14 per cent increase of average prices for all 3 categories of services. In high HDI countries, the increase is more than 21 per cent. Contrary to all other groups, in medium HDI countries, monopolies seem to bring down the average connection costs of services. As a group these countries pay only slightly above 80 per cent of the average charges of other countries within the group. The countries that bear the largest burden are again those with low HDIs. In this group, monopolies on telephone services are more than doubling connection charges as compared to other countries within the group.

Table 2: Changes in connection charges of telephone services

HDI classification	**Business telephone connection charge as % of GDP per capita**		**Mobile cellular connection charge as % of GDP per capita**		**Residential telephone connection charge as % of GDP per capita**		**Total dimensions with monopolies on ICT services**
2007	1990	2008	2002	2008	1990	2008	2008
Very high all	0.8	0.3	0.1	0.1	4.5	0.2	5.3
Very high with monopoly	0.8	0.2	0.1	0.1	0.6	0.3	5.3
High all	7.4	0.7	0.5	0.1	1.9	0.5	6.4
High with monopoly	3.3	0.3	0.6	0.2	4.4	0.6	8.5
Medium all	34.0	2.1	1.3	0.5	6.8	8.4	5.1
Medium with monopoly	4.9	2.5	1.4	0.4	11.0	3.0	8.1
Low all	18.3	9.7	5.1	1.2	16.4	9.8	4.7
Low with monopoly	19.7	29.9	6.7	2.8	11.5	11.0	7.3
World	16.6	1.9	1.6	0.4	6.5	4.4	5.3

Source: Adapted from ITU 2009c.

Research conducted in 30 developing countries demonstrates that an effective regulatory authority coupled with privatisation can increase ICT diffusion and service access but regulation must be put into place early to assure that foreign private interests are not favoured above those of the local population (Wallsten, 2001). Another survey of 177 countries further shows that aggressive reform and the introduction of competition in the telecommunications sector has a direct impact on the successful diffusion of ICTs (Li and Xu, 2004). Seeing the above numbers shines additional light into this issue which will be discussed further below.

Ultimately, before ICT4D can take off at the individual or even at the household level in the developing world, especially in countries with a low HDI value, policy makers will need to address the gaps on access to electricity and the lack of regulation on costs of ICT services and not only increasing incomes of the poor. These are fundamental dimensions that have severe

impacts on ICT use in most developing countries. Furthermore, as these technologies continue to spread, another important dimension to consider is the environmental impact from the production, use and disposal of ICTs (ITU, 2009a). It is estimated that ICTs as a whole have contributed 2 per cent of all CO_2 emissions between 2002 and 2007 and will reach 3 per cent by 2020 (POST, 2008). The disposal of ICTs as waste, of which an important part is hazardous and toxic materials, is another important issue since millions of metric tons of ICTs are improperly disposed as garbage every year (UNEP, 2009). It is therefore vital that the environmental impacts of ICTs figure as part of national telecommunication strategies to ensure their environmental sustainability and limit their contribution to environmental degradation and climate change. As statistics on ICT use continue to climb around the world, ensuring the environmental sustainability of the technologies will be an increasingly important challenge.

Statistically speaking, there is still much that needs to be done in terms of investments in infrastructure and accessibility for ICTs to reach near universal access. Looking at the trends outlined above, we see great inequality and disparity between HDI groups. When reviewing the data supplied by ITU (2009c) we also see great inequalities between regions. Based on the review of the characteristics of the digital divide in the earlier section, we can infer that the same is true within countries. What is encouraging though is the speed at which developing countries are closing the gap with the developed world, especially in terms of access to mobile phones. With the convergence of voice and data through increasingly advanced mobile handsets, it is easy to imagine that access to the Internet will see important growth in this group and perhaps significantly so in the next 5 to 10 years. Encouragingly, table 1 demonstrates that there has been convergence in access to ICTs since 1990 between developed and developing countries and that this convergence has been most dramatic in the past five years thanks to the incredible spread of

mobile phones, which make up the largest user base of ICTs surveyed and are the focus of an increasing amount of research on the potential benefits of ICTs for development. Because of their low costs and high penetration rates in most developing countries, mobile phones are according to many academics an ICT that may have tremendous potentials for improving the lives of the poor (Ling and Donner, 2009). There is evidently much progress that is still required in developing countries to achieve the levels of access and use of ICTs in developed countries, and few may actually catch up to this group that has been at the forefront of technological production and use since the beginning of ICTs. Given the data presented above, and if current trends maintain themselves, we can nevertheless be optimistic that the gap will continue to shrink.

ICT, Empowerment and Participation

Empowerment can be defined as a process of "enhancing an individual's or group's capacity to make effective choices and translate these choices into desired actions and outcomes" (Alsop and Heinsohn, 2005: 5). Together with participation, which entails having the opportunity to be involved in decision making processes, empowerment is an important dimension of human development. Access to ICTs can have tremendous impacts on peoples' sense of empowerment and ability to be active participants in their societies at both social and political levels (Brown et al., 2001; Kleine, 2009). Norris (2001) is a firm advocate that ICTs can enhance the empowerment of civil society by augmenting their capacity to work as organised networks both within and beyond borders. For example, the Internet can increase opportunities for political activism through online networks that can compliment physical networks. She understands the digital divide in three ways: the global divide, the social divide and the democratic divide. Each

of these dimensions can both permit and limit the potential for empowerment. They have positive and negative implications on the choices and freedoms available to users based on individual, cultural, social and political realities (such as gender, ethnicity, age, income and liberty). When these barriers are overcome, ICTs can greatly enhance civil society's ability to promote change by creating channels of communication that facilitate collaboration on common goals. In a sense, these tools can be significant amplifiers of voices for change (Cammaerts and Van Audenhove, 2003). In particular, ICTs are most effective when they are seen as means of engagement and enhancers of participation, which are crucial for human development because, "Any development programme that regards people as mere recipients, rather than as the actual creators of change and progress, usually fails" (Fraser and Villet, 1994: un-paginated).

By making content available online and creating avenues for engagement, governments can also positively influence the adoption of ICTs by being active users themselves (Borge, 2006). By creating linkages to governmental processes, ICTs can contribute to increasing the transparency of governmental processes and contributes to the empowerment of citizens and civil society by promoting their participation in policy debates. By investing in the creation of a proper environment with incentives and means for use, governments can positively impact the likelihood of the use of ICTs. The Internet in particular can be an effective platform for increasing participation and, for example, the transparency of governmental processes and budget allocations by allowing the creation of websites that feature such information. Infonet, created by the Social Development Network of East Africa, and FarmSubsidy.org, a non-profit project in Sweden, are built on the principle of freedom of information (TTC, 2009). The former posts government funding allocations for development projects and the latter government subsidies to farming sectors. These websites both allow the distribution of data via the Internet,

and in Africa through mobile phones, and have created spaces where people can post questions and comments online. These portals quickly became vehicles to scrutinise the governments' support and funding for projects and enterprises in their communities. The East African initiative has allowed users to review the use of funds for more than 36,000 projects in the region thereby empowering them to exercise pressure on their respective governments so that spending reflects local priorities and benefit local communities (ibid). Making important administrative information freely accessible online, as does the Office of Management and Budget (OMB) of the United States Government, is another example of ways by which ICTs can increase the transparency of a country's administration. Their public access website allows users to review annual budgets going back to 1996 along with important policy documents and data for legislative, executive and judiciary branches of government (OMB, 2010). As Guida and Crow (2009: 301) observe, "the relationship between e-government and ICT4D is reciprocal; the investment in technology and skills necessary to make e-government relevant also builds the foundation for a networked world, and e-government services themselves can be a draw to entice citizens to participate on the internet." Applying the human development and capabilities approach in this way can be effective in "forcing policy makers to face the complex challenges of equity of access with respect to vital resources and capabilities, the sustainability of resources and institutions, the acquisition and distribution of knowledge for human empowerment and people's participation" (Hamelink, 1999: 35).

The use of community radio is a common example of the positive uses of ICTs for development and community empowerment. Jewel (2006) demonstrates that the use of community radio in Bangladesh strengthens local democratic processes by putting the tools and the responsibility for content creation in the hands of the community. The technology was used

to promote political participation through the sharing of information and discussion of issues that have an impact on peoples' lives. Community radio was not only seen as a tool for empowerment and participation but also an effective means to promote local culture and values. An advantage of radio over other forms of ICTs is its general pervasiveness across the world and relatively low cost of ownership. In making community radio a development priority, CIMA (2007: 9) states that, "The potential of community radio to bring about social change is not a matter of mere observation but… an empirically proven fact". The other side of the coin is that ICTs, such as radio, can also be used to curtail freedom and be made into tools of oppression and violence. The known cases of radio transmission and calls to genocide in Rwanda in 1994 are grim reminders that technologies themselves do not guarantee any prescribed outcome or contribution to development. In this case, radio served to fuel hatred and was a tool to mobilise mobs to commit genocide (Des Forges, 1999). As this sombre example reminds us, technology may be used and "serve to tyrannize publics as well as to liberate them" (Rosenau and Johnson, 2002: 55).

As tools for dissent and mobilization, ICTs can facilitate the distribution of alternative voices and information, which can be threatening to authorities. Analyzing Usenet groups and chat-rooms, Hill and Hughes (1998) have discovered that political opinions formed the most substantial part of online exchanges in states that were commonly considered repressive. Many governments have realized these powerful facets of ICTs and therefore attempt to render traceable the identity of Internet users. The debates on child pornography and terrorism constantly resurface as legitimate concerns and reasons for eliminating anonymity online yet many advocates of online freedom fear that these causes are but scapegoats of something greater and ultimately represent a push for politically geared censorship (Slevin, 2000). The policies of Burma, China, Cuba, Egypt, Iran, North Korea, Saudi Arabia, Syria, Tunisia, Turkmenistan,

Uzbekistan and Vietnam make them the most repressive states for Internet use in the world today (RSF, 2009). The ECHELON system, managed by the United States, the United Kingdom, Canada, Australia and New Zealand, also comes to mind for those who are familiar with global digital monitoring and surveillance systems[1]. Issues of censorship and monitoring are fundamental to the use of ICTs (Jordan, 1999), and a state wanting to control the use of these technologies has many options from the physical control of equipment and services to the blocking of online networks (Castells, 2001). Liberty, or the lack of it, has repeatedly been an obstacle to the accessibility of information in societies that are undemocratic or repressive. News media censorship and control of the Internet are two facets of the same coin in the Information Age, and are both intricately interwoven. Kedzie and Aragon (2002) caricature the adoption of ICT in repressive states as "the dictator's dilemma" because these tools can both be gateways to wealth and influence while also being potential channels of dissent and civil mobilization.

Several Asian states are at the forefront of technological advancements in the control of ICTs and recurrently surface when discussing online censorship. These states regulate and limit access to the tools themselves, the Internet and a slew of websites that host content deemed illegal. Licenses, fines, and imprisonment serve to reinforce state systems that seek to control and censor civil society's use of the Internet. This has been the case in Singapore, a country known for its successful economic development policies but otherwise an author of repressive Internet legislation. Although set on maintaining their image as a technological leader and the 'information hub' of the Asia-Pacific region, there have been within the state strong commitments to control the reigns of political opinion (Rodan, 1998). The banning of satellite television, the control of foreign press and the control of Internet Service Providers (ISPs) are all

[1] An introduction to ECHELON is available at: http://en.wikipedia.org/wiki/Echelon_(signals_intelligence).

strategies that strongly undermine the civic potential of ICTs in the country. Singapore's case demonstrates the ease with which governments may monitor and investigate online activity. In this country, the use of ICTs for political activism has been marred by fear and suspicion because the government, acting as both owner and regulator, has either directly or indirectly controlled all ISPs within the country. This consolidated approach to managing technology has permitted the government to monitor users to the extent that websites discussing religion or politics have had to be officially registered in order to be legal. Additionally, privately owned ISPs have been liable for content deemed subversive that is hosted on their servers or posted through their services. Similarly, publishers of online media were obliged to assist the government in its investigations of dissent by making public all their records of use and content creation. The Newspaper and Printing Press Act, applicable online, was created to impose as much self-control and self-censorship as possible through a system of licences and penalties. The success of this model was acclaimed in 1996 by all members of ASEAN, except the Philippines, as the best means to control the Internet and was a foreseeable action to be implemented by members of the association. The model was clearly replicated in Burma where mandatory licenses for ownership of many ICTs, including fax machines and modems, are given only to those who are trusted by the government; unlicensed users are imprisoned when discovered (Dudley, 2003). This context renders public access Internet, such as cyber-cafés, virtually inexistent but as was discovered, clandestine uses of such ICTs, despite the risks involved, are observable in the country (ibid). ICTs have despite these obstacles become central for the country's international solidarity movement who struggle to establishing communication links with activists within the borders of the country. These links are vital given that, as Reporteurs Sans Frontières (2006) report, many foreign media are simply illegal in Burma and along with human rights advocacy are repeatedly

labelled foreign interference into domestic affairs. Nevertheless, local bloggers continue to find new and innovative ways of circumventing censorship and control of the Internet and are able to post comments, upload videos created from mobile phones and small video cameras and spread information of the ongoing political repression in their country (TTC, 2009).

China today demonstrates perhaps the most advanced forms of control and censorship of ICTs. With climbing amounts of arrests and imprisonment of Chinese journalists, on charges of espionage and threats to national security, China positions itself as a firm obstacle to online freedom of expression (RSF, 2006). Google's acceptance to include in their Chinese version of the popular search engine automatic blocks and censorship of keywords and sites determined to be subversive by Chinese authorities was a clear indication to the world that the country was not ready to open itself to increased transparency.[2] Yahoo!'s collaboration with Chinese officials, resulting in the arrest and imprisonment of a local journalist on charges of dissent because of a critical blog posting is another sombre example of the Chinese ability to restrain freedom of expression (RSF, 2005). As Chase and Mulvenon (2002) suggest, the advent of the Internet in China has drastically altered the power structures and capabilities of both the government and civil society. Civil society's new found technological ability to exchange ideas and information has triggered governmental 'counter-measures' to seek out and punish activists. Despite the threat of imprisonment, local Chinese activists are continuing to compile email lists, authoring websites, finding ways to circumvent barred access to websites of organizations such as Human Rights Watch, the British Broadcasting Corporation (BBC), Amnesty International, and

[2] Censoring all content deemed subversive by the Chinese government, 'google.cn' was launched in 2006. A spokesperson at Google was quoted defending the decision by saying that, "While removing search results is inconsistent with Google's mission, providing no information… is more inconsistent with our mission" (BBC, 2006). Continued controversy and rising tensions about censorship in China led to the closure of the site in 2010 (New York Times, 2010).

countless more, and adapting peer-to-peer networking software for the sharing of political documents. This is truly "Internet guerrilla warfare" against silence, propaganda, and control of citizens' voices (ibid: 31).

Despite such obstacles, the potential of ICTs to empower social movements, promote participation and assist in the mobilization of people as agents of change was made evident countless times around the world, the most recent example being in Iran following the elections of 2009. As a response to the outcome of the vote, masses of demonstrators defiantly took to the streets in protest. The government proceeded to crack-down on all means of communication, including the press, in order to limit the spread of opinions that openly criticized the government. During these violently repressed demonstrations, Twitter users with mobile phones were able to keep a window open into the events of Tehran despite the government's efforts to the contrary (Poniewozik, 2009). International news outlets consequently found on the Internet a collection of live feeds of the events on the streets. The result was live broadcasting around the world of repression and shooting of unarmed civilians. These images shocked the world and their repercussions are still being felt in the press since they have severely affected the image of the political leadership in Iran. Similar events unfolded in Ethiopia in 2005 after another deeply contested election. Despite laws defending press freedoms, freedom of assembly and freedom of expression, student groups, political opposition parties and several media outlets became targets of a massive crack-down on political opposition to the re-election of the government. With protests on the rise across the country and reports of arbitrary arrests and detentions, text messaging capabilities on mobile phones within the country were suddenly disabled by the telecommunications service provider who has a monopoly over the service (USDS, 2006). This decision was surely made to limit civil society's capabilities to organise and exhort pressure on

the government. Such examples are not limited to developing countries, as was demonstrated by the Independent Media Collective, commonly known for its website domain Indymedia.org. They have experienced firsthand the extent to which democratic governments are ready to dismantle and even attack independent news outlets when they consider the censorship of information a political necessity. This was the case in Seattle (United States), Québec (Canada), and Genoa (Italy) during massive anti-globalization protests occurring between 1999 and 2001. Police raided the sites of online broadcasting, seized computer equipment, and arrested civilians for their roles in disseminating first person accounts of the protests and the police repression that ensued (Kidd, 2003). It is therefore important to consider the safety of users in using ICTs for political mobilisation and information dissemination, especially when they are located in undemocratic societies where state violence, repression and censorship are common. Amnesty International concurs that in their work, ICTs are powerful tools. It is the distributive capacity of email and the Internet that can enable the 'deterritorialization' of activism by facilitating, coordinating, disseminating, and mobilizing efforts at social change across the world (Lebert, 2003).

Although the examples cited above all seem to have ended with little or no resolve due to repressive measures by governments, ICTs can become means to enhance the capabilities of individuals and communities to make choices and become active agents of participation into the political processes that govern their lives. The latter was proven to be possible in Timor-Leste prior to its independence from Indonesia. In this particularly violent period of the nation's history, all channels of communication were monitored and controlled by Suharto's military. In order to circumvent this barrier, computers were smuggled into the territory and installed under floor boards to avoid their detection (Hamel, forthcoming). In tandem with supporters overseas,

local human rights and sovereignty activists clandestinely collected stories of human rights abuses and tactical information on the military's presence in the territory. This information was channelled to one location in particular where use of Pretty Good Privacy (PGP) encryption masked the contents of the information being funnelled out of the territory through communication channels created with ICTs. The individuals involved in these networks all served to "sway international public opinion" in favour of Timor-Leste (Budiardjo, 2004: 70). This use of ICTs was not unique to Timor-Leste during the final years of Suharto's reign. Across Indonesia, the Internet became a parallel form of public media that escaped the censorship of the press and facilitated the distribution of dissent and opposition to the policies of the aging dictator (Hill and Sen, 2005). As this case demonstrates, the ability to connect people, a strategy that proved vital to organizing major simultaneous demonstrations across the country, ICTs can facilitate the distribution of content that can tip the scales of power. Printed copies handed out, faxed, posted in public places and even sold alongside official press publications all serve as testimony to the resourcefulness of individuals in the attempt to overcome the limits of censorship and the digital divide. With its proven efficacy in bypassing media censorship in the months leading up to *Reformasi* (the reform), the Internet can be an effective technology when both criticizing an oppressive regime as well as seeking support and solidarity against it (Lim, 2005). One of the strengths of the Internet in this example has evidently been its ability to expose the propaganda published by government controlled press agencies in Indonesia therefore stimulating public debates within the country and abroad (Hill and Sen, 2005).

Solidarity networks have existed prior to the advent of ICTs but it is fascinating how, from the onset, these technologies have become tools for resistance and alternative communications around the world. Another well-known and documented example is that of the Zapatistas in

Chiapas, Mexico, who in 1994 started making use of the Internet to engage directly with press agencies around the world to win support for their cause. Equipped with a laptop computer and a modem, the movement opened a line of communication between their isolated group in rural Chiapas and networks of supporters and the press, who were all interested in covering the quickly escalating conflict and stand-off between this indigenous group and the Mexican government (Froehling, 1997; Morello, 2007). As Froehling (1997: 291) writes, "The Internet rapidly became an important tool for disseminating information and organizing support on an international level, and it provided a forum in which events were watched by a variety of civil organizations, thereby limiting the possible range of actions for a government concerned about its international image." Their successful use of ICTs enabled them to circumvent the Mexican government's official message and perspective on the conflict thereby significantly increasing their negotiating power and becoming an important political entity in the country (Morello, 2007). More contemporary uses of the internet by civil society include the reporting of human rights violations by activists on the ground through blog style websites. In these examples, local civil society organisations are making use of the World Wide Web to publish human rights information that is rarely discussed in the press and in the broader society. In Egypt for example, a country termed an enemy of press and Internet freedoms (RSF, 2009), a website was created by a local journalist to document instances of police brutality. In an attempt to bring accountability to the police department, videos and photos are posted along side testimonials in order to mobilise support for individuals who at times can be wrongly accused of crimes they did not commit and to end violence and corruption in the ranks of the police department. As TTC (2009) reports, this portal has been successful in the liberation of at least one wrongly convicted person and has brought attention to the issue of police brutality in the country. The authors also

document examples of blogging against injustice in Belarus, Burma, the Democratic Republic of Congo, India, Lebanon, Madagascar, Morocco, South Africa, Sweden, Tunisia and Zimbabwe.

Having reviewed government attempts to thwart expression and mobilization it is important to remember that these political outcomes of ICTs are not the only dimensions of empowerment and participation that are observable in the field. For example, mobile phones are proven to be effective tools that can help people deal with shocks by allowing them to mobilise resources within their family networks and facilitate the reception of remittances from contacts both at home and abroad (Hamel, 2009). They can also help nourish social and cultural bonds over long distances and across borders, helping people preserve their sense of identity despite migration (ibid). These are arguably examples of human security but ICTs also allow new forms of personal insecurity as was documented in Kenya where women users of ICTs are often victims of harassment and violence due to the vulnerability of online information. While online spaces can allow people to express themselves in privacy and with anonymity, they can also be usurped for criminal ends such as stalking and physical abuse, as in these reported cases of violence against women (Munyua et al., 2010).

Successful use of ICTs to enhance human development, empower and involve the participation of stakeholders is in most cases characterised by the ability to have a direct and positive impact on the problems and obstacles that exist in peoples' lives (Day and Greenwood, 2009). Engaging the local community is a critical factor in meeting these objectives. The use of ICTs in development therefore needs to be conceptualised from the ground-up since top-down approaches have failed many times simply because they did not meet user's needs and they did not take into account the particular context in which they operate (Robinson, 2006). As demonstrated above, understanding the needs for the personal security of users is of immense

importance in some contexts. Involving stakeholders into the decision making and design processes are therefore important contributions that increase the likelihood of success of ICTs in development since successful ICT4D assesses the capabilities and goals of stakeholders in order to design systems that are valuable to them.

ICT and Health

The modern notion of health is intimately tied to technology (WHO, 2004). From the clinical understanding of illness, its successful diagnosis or the practice of medicine itself, technology has become omnipresent in the field. In the practice of development, the intersection of ICTs and health is commonly called e-health. It is essentially the use of ICTs in medicine for knowledge management and service delivery, a combination which can essentially improve the delivery of medical services and can by consequence improve health outcomes (UNDESA-GAID, 2009). The World Health Organization (WHO, 2007) determines that there are five essential components to e-health: structural enhancement in the delivery of health services, engagement with stakeholders and the private sector in improving the availability and appropriateness of technologies, learning how to use the tools, creation of standardised norms and practices, and evaluation and monitoring of the application and impact of ICTs to health. E-health is essentially a collaborative model that functions as a network of experts and resources that are able to be mobilised at a distance and beyond borders. The use of ICTs in medicine has been common in developed countries for several decades now. The impact of ICTs to the practice of medicine and the management of health services cannot be overstated. A study of “Enhanced 911” services in the United States, meaning an emergency response system that includes database driven applications such as automatic address identification and information management, greatly

"enhances the timeliness of emergency response" and "reduces mortality and hospital costs" when they are coupled to broad organizational reforms and strategic resource allocation (Athey and Stern, 2002). Although many would point out obvious obstacles to such systems in developing countries, such as the lack of standardised street addresses, the creation of digital records, databases for tracking the spread of disease, online resources on treatment and diagnosis of illness, management tools, support for clinical care, publishing of research findings and alerts, collaborative approaches to dealing with pandemics, and recent advances in telemedicine make ICTs an essential part of the practice of medicine today in all corners of the world (Yunkap Kwankam et al., 2009). Surveillance and information gathering systems that allow the recording and analysis of data on spreadable diseases is an example of ICTs in this field and is essential in managing the safety of populations (Bellows et al., 2006). Accessibility of research findings and publications, especially access to medical journals, is an important dimension of the role of ICTs in healthcare. There is already a large body of medical knowledge that exists in the world and is accessible on the World Wide Web through electronic subscriptions and medical associations. Extending access to these resources can become an effective dimension of aid in the development of medical practice in developing countries (Wresch, 2009). With the recent advent of the Internet, techniques and information that were once the domain of national and even local networks of health practitioners now have the potential to be shared across much larger geographies. The key is the establishment of shared standards that allow for the posting and sharing of medical information by multiple users in diverse contexts. Once these are put in place and agreed upon by stakeholders, the potential of e-health can greatly impact the practice of medicine, especially in remote areas (ibid).

E-health systems exist in various degrees of complexity and address myriad needs and objectives. Many are already familiar with health help lines, where medical advice is readily available and only phone calls away. More complex systems, such as the Heartbeat Jordan programme and an equivalent initiative in Ethiopia, allow medical experts to give advice to doctors in remote areas where either no specialist is present or travel by the patient to visit a specialist is impossible. In Jordan, the use of ICTs for remote diagnostic of patients gradually resulted in reductions on the need to mobilize resources in order to bring patients and doctors together. Some impressive outcomes include the reduction of unnecessary visits to the limited heart specialists of the country by a factor of 50 per cent, representing cumulative savings of millions of US dollars for the health system of Jordan. Similar outcomes have been reported by the South African Department of Health which has also established remote diagnostic services in order to maximise access to medical specialists, with a particular focus being placed in remote areas. Other outcomes include decrease of medical errors as a result of increased access to information and expertise. "Telehealth, electronic health records, computer-assisted prescription systems, accessing clinical databases and other aspects of e-health are transforming health today and hold even greater promise for the future" (Yunkap Kwankam et al., 2009: 254). As the technologies continue to evolve and their use becomes more ubiquitous, the field of medicine will see further increases in its capabilities through enhanced "remote consultation, coordination, and diagnosis" (Bellows et al., 2006: 247).

What is inevitably at play in the use of ICTs for health is essentially the creation of shared knowledge management systems that are accompanied by infrastructure and access to equipment. Essential to their success is also the need for stakeholder participation in the design and implementation of development solutions. Consensus has been established that this is true of

all ICT driven initiatives, in all fields of intervention. For example, the successful implementation of an e-health project in Peru by the Hispano-American Health Link engaged health practitioners from the very beginning of the project. Surveys were used to determine the needs of users as a precursor to designing the system, as opposed to building a tool and expecting the users' needs to adapt to it. The outcome was the establishment of an information sharing and training network that mainly functions via email to send training materials and health alerts on topics of immediate relevance to health practitioners in the field. The project makes use of solar power and sends it signal using radio waves to overcome geographical obstacles and lack of infrastructure within the communities where they are active (Martinez et al., 2002). The creation of the Baobab system of electronic records in Malawi, which has effectively cut down waiting and registration times related to a range of administrative processes, is another simple example of how ICTs can assist health practitioners better manage their time and resources making the health delivery system of the country increasingly efficient over time (UNDESA-GAID, 2009).

An immense gap inevitably exists between the implementation of such systems in developed countries and their counterparts in the developing world. A common position is that although ICTs can significantly increase the reach and resources of medical practitioners in developing countries, policymakers must take into account urgent medical needs. ICTs need to be designed and implemented as to complement urgent local needs and not compete against them. Each developing country is battling against a unique set of health problems. Although there are some regional similarities, resources and infrastructure are highly differentiated across the globe. It is therefore important that any technological intervention into the practice of medicine and healthcare delivery do not impede upon the potential for health practitioners to tackle immediate needs. As Rodríguez and Wilson (2000) observe, there can be negative associations, or tradeoffs,

between technology and public spending and this has been observed in the context of health care spending between the years 1994-96. A balance needs to be struck between the long term potential of financial savings that are possible from incorporating ICTs into healthcare systems and immediate needs to meet demands. In tackling these concerns, Yunkap Kwankam et al. (2009) identify a series of obstacles that need to be remedied to enhance the benefits of e-health. These can be summarised as: organisational structures, legal and ethical policies and evidence-based decision-making. There needs to be a clear indication that the field is ready to support and utilize technology in a way that will positively contribute to the delivery of healthcare and enhance health outcomes of the country. As the authors note,

> "Despite the great potential of e-health, many countries, especially in the developing world, are unable to derive benefit from it because they lack the capacity systematically to evaluate developments in ICT and make informed decisions about potential applications, country readiness for their adoption and adaptation to country-specific needs, circumstances and resources" (ibid: 277).

This observation also applies to the design of electronic health systems. Research on the development of electronic health information systems in India illustrates the need to consider the expected results of creating new systems. It is not enough to define the form that data must have when it is entered into a system; stakeholders need to be clear on the desired outcomes of electronic health systems and the means to make the data actionable so that the richness of information that is accumulated can be used by health practitioners in the field (Ranjini and Sahay, 2006).

Considering the importance of access, sharing and distribution of information in healthcare and the practice of medicine, such obstacles as those noted above desperately need to be

overcome in the developing world. Bellows et al. (2006:236) advocate this necessity based on the idea that "the intersection of ICT into health may be one of the greatest means to positively enhance development." The important element to this success is that the use of ICTs always be combined to broader efforts at reform of health care delivery and strategies to increase outcomes in this dimension of human development (UNDESA-GAID, 2009). A recurrent observation in the literature is the important realisation that ICTs alone cannot change peoples' lives, they need to be part of broader strategies that are tailored or reformed to make the most use of them in order to reap their potential benefits. In making ICTs part of broader efforts to impact the health outcomes of people in development, it is advocated that governments must play a major role. Able to mobilise "political capital, financial resources and organizational capacities", ICTs are most effective in the health dimension of human development when fully incorporated in national health plans and strategies (ibid: 9). Partnerships with the private sector are again essential to these aims in order to reduce the costs associated with the use of these tools. Given the limited resources of governments in developing countries in combating poverty and delivering quality health services to the poor and the review of existing strategies and outcomes in many developing countries, the overall priority of policy makers must rest in assuring that any decision and consequential investment in e-health be accompanied with sufficient financing, proper organizational reforms and development strategies that will deliver not only short-term results but long terms gains in health outcomes for the poor (ibid). An interesting analysis that sought to assess if the mere presence of ICTs and their use could have spill over effects to peoples' health measured the presence of ICT infrastructure in 70 developing countries over the period 1960-2004 and found a positive correlation between the presence of information and communication networks and malaria survival rates even after controlling for wealth and other

economic indicators, which would distort the analysis due to the fact that “more telephones and TV sets are associated with people who earn more money, live in urban areas and have better track record of immunization” (Monzumber and Marathe, 2007: 4). Health outcomes are important measures of development and research shows that ICTs have the potential of positively contributing to them when they are part of well planned nationally tailored interventions. Information can save lives and ICTs are designed specifically to facilitate the sharing and retrieval of knowledge that in the case of health and medicine can mean life or death.

ICT and Education

The benefits of online information are a source of great optimism and offer immense potentials for ICTs to fill a large learning resource gap in the developing world. This is a primary reason for many in the field of education to advocate that the biggest role of ICTs in education is their use as means to enhance learning (Selinger, 2009). Interestingly, the creation of new learning materials coupled with a push for increased technology in the classroom is not new. Angrist and Levy (2002) note that as far back as the 1920s, motion pictures were seen as a major improvement to pedagogical materials in the United States. In the 1950s, “teaching machines” were imagined that “would make learning dramatically more efficient” and allow the emergence of an education system that would increasingly be home-based (ibid: 735). We now have such devices through the combination of home computers, online courses and distance education which allow students who have access to such technologies to be enrolled in school programmes that are perhaps on the other side of the globe and otherwise unavailable to them in their community or even in their country. No one would argue against the potential added benefits that distance education can bring to the learning opportunities of people around the world but what

about the presence of ICTs within classrooms? Many researchers are still rather sceptical about the benefits of ICTs for education because of the often lacking measure of their impacts to both the quality of education and its outcomes, i.e. the skills and knowledge imparted onto students. Cuban (2001) conducted research in the schools in communities around Silicon Valley and Stanford University in the United States and discovered that despite this region's and university's reputations for being breading grounds for technologists, he found no evidence that the presence of ICTs was positively contributing to student learning. In their review of government initiatives to bring ICTs into classrooms of the United States, Angrist and Levy (2002) also conclude that massive investments did not translate to increases in knowledge and skills for the students. They report similar findings from Israel where the equipment and related costs of ICTs could have financed the salaries of up to four additional teachers per school. Enlarging the area of study beyond the classroom, Fuchs and Wößmann (2004) analysed the relationships between learning, computers and the Internet both at home and at school and actually uncovered negative impacts in students that made above average use of the technologies outside of the learning environment and disappointingly, they also reported insignificant learning impacts from ICTs in schools. The outcomes of these studies disprove the assumption that ICTs can lead to better education and forces researchers to ask what can be most effective, more teachers or more computers. Of course the question is obsolete if the objective is to teach students about IT but if the aim is to enhance learning more broadly then the strategy may be deeply flawed, especially in developing countries were resources are scarce. As infoDev (2005) notes, "It is generally believed that ICTs can empower teachers and learners, promote change and foster the development of '21st century skills, but data to support these beliefs are still limited".

On the other hand, ICTs are also believed to be able to contribute to the enhancement of learning in the world since these tools can play a role in reforming education systems, increasing access to pedagogical resources, improving the management of education and enhancing pedagogical techniques (World Bank, 2002; infoDev, 2005). There is clearly a deep contradiction within the literature which demonstrates the many challenges of evidence-based policy making for development. Outside of actual IT curriculum, where learning about technological tools may be important for the completion of courses and the preparation for a career in the field of IT, ICTs in education are generally agreed to be best used as tools to illustrate information, to present information in new ways and to improve access to information (Selinger, 2009). ICTs are seen as especially well suited means to distribute and access learning resources which in turn have great potential for impact in rural areas where resources such as books and libraries are scarce and ICT infrastructure is present. "ICT can be a catalyst by providing tools which teachers use to improve teaching and by giving learners access to electronic media that make concepts clearer and more accessible" (ibid: 214). This view downplays the importance of ICTs themselves and reinforces the importance of having access to pedagogical materials above all else.

As is evident throughout this paper, the issue of appropriateness of ICTs in a given context coupled to the conditions of their access must always figure in the analysis of their value and potential contribution to development. Access can be seen "in terms of not only the physical presence of a particular technology, but also its reliability, its cost, its cultural acceptability, the ability of people to use it and the relevance of the content that is available to them" (Unwin, 2009e: 70). When discussing ICTs in education, the issue of access is especially relevant in all of these dimensions. With the high costs of having access to the Internet and the unreliability of

electrification in many developing countries, building libraries may be more appropriate then purchasing computers and connecting to the Internet for many poor communities. For example, in Africa, the average capacity of an Internet connection for a whole campus can easily cost as much as eight times the average annual income and yet be much more restrained than the average high speed connection in North American or Europe which costs a fraction of the price (Selinger, 2009). The challenge facing those who aspire to make available the benefits of new ICTs to poor and marginalised communities is to ensure that all of these conditions of access are met" (Unwin, 2009e: 70). Furthermore, in those contexts where making use of ICTs in education makes sense, there is the added obstacle that a wide collection of content available online that can serve the needs of educators in developing countries is not available in a local language. Access not only means overcoming the technical obstacles and lack of skills that act as barriers between the user and the resource but also bridging the divides such as language, which impedes understanding. An important dimension of increasing the benefits of ICTs is therefore the need to make content available in local languages across the world. This is of great importance when considering the potential of online content in pedagogy (ibid). The recent approval of internationalised domain names by the Internet Corporation for Assigned Names and Numbers (ICANN), the top level domain regulating body, will significantly improve the use of local languages on the World Wide Web by allowing the use of non-Latin alphabets in domain names, and therefore in navigating the Web. This means that websites in China or Saudi Arabia for example will now be able to have domain names in Chinese or in Arabic characters instead of their Latin alphabet equivalents. The Internet will as of 2010 truly be a global platform able to handle text that is input in all major written languages (ICANN, 2009).

Placing some of these concerns aside, Selinger (2009: 221) suggests a model for applying ICTs to education in developing countries that considers five dimensions: "connectivity, technology, content, leadership development and teacher training". Her research has determined that for ICTs to have significant impacts in education, one must begin by assuring that the curriculum used in the courses can benefit from ICT use. This also implies the proper training of teachers so that they are able to make the most use of the tools and that this new direction be promoted at the highest level within the learning institution. This will also require investments in equipment, infrastructure, monitoring and management of the new learning resources. The ongoing support of teachers is of particular importance to assure sustainability of these investments and maximum benefit to the students since there needs to be a shared vision that is developed and maintained by all stakeholders, including private sector partners, telecommunications service providers and donors (ibid). The Open Learning Systems Education Trust (OLSET) can serve as a model that can greatly facilitate these processes and facilitate distance learning and education by means of shared online resources and training curriculum. Based in South Africa, OLSET works in collaboration with the government to reach over 1.8 million students and 52,000 teachers within the country. Through ICTs, they have set out to improve access to education and improve the quality of teaching. They have been successfully reaching these goals for over 16 years (OLSET, 2010). This is a good example of support for distance education, which is an important component of enhancing the quality of education in many developing countries, especially in sub-Saharan Africa (Mattson, 2006). Another example of successful use of ICTs in education is the case of the EU-China Gansu Basic Education Project. By creating videos and television programmes as vehicles to distribute curriculum, the project was able to launch a series of resources that have impacted more than 90,000 teachers in

rural schools across the province of Gansu. Some of the essential components of that success were the establishment of more than 680 teacher centres, located exclusively in rural areas and servicing on average 12-20 schools each, and the distribution of equipment to make use of the resources within the classroom setting. The success of this project is now being replicated in other provinces of China for an even deeper impact across the country (Robinson, 2009).

Making ICT in education a reality requires a commitment from governments and institutions of learning to guarantee funding and investment in ICTs only if it is a well calculated investment that outweighs alternative uses of those resources. Such a strategy should be in line with broader national ICT policies and programmes to promote synergies in use and infrastructure in order to reduce costs. Such commitments will also require in many settings training for educators who may not have the technical skills for use of ICTs in their classrooms. The varying levels of commitment to this goal are clearly illustrated by comparing data from various countries on the African continent. As of 2006, virtually all public schools of Egypt have computers whereas in Namibia and South Africa, the figure barely surpasses 20 per cent (Isaacs, 2006). Direly, in Ghana and Mozambique, the figure lies below 3 per cent (ibid). When looking at electrification rates for correlations with the above, Egypt, with 62.4 per cent of its population living without access to electricity, does not fare much better than Namibia with 66.7 per cent, South Africa with 24.4 per cent and Ghana with 48 per cent (IEA, 2008). InfoDev (2005: 5) reminds us that even in rich countries ICTs are “rarely seen as central to the overall learning process”. They advocate that setting clear goals and objectives for ICT in education are essential to monitor its results and impacts on learning and that all too often this is not done which can make them ineffective tools for pedagogy. Furthermore, they observe that “little is known about the true costs of ICTs in education”, that “even less is known about cost effectiveness, especially in

LDCs" and that total cost of ownership is "typically underestimated in planning exercises", thereby contributing to the risk that ICTs may divert important resources away from more proven and effective approaches to education (ibid: 19-20). As was the case with ICTs in health, there is a largely untapped research area that can clarify many of these concerns by means of genuine cost benefit analysis to evaluate the true potentials of ICTs in education, especially in developing countries.

ICT and Income

The economic benefits of ICTs on income and more broadly speaking economic growth were heavily debated during the emergence of this sector (Brynjolfsson and Hitt, 1998). Known as the productivity paradox, the lack of positive correlation between the increased usage of computers during the 1970-80s within various sectors of the American economy and measures of productivity, such as in the service industry (Roach, 1987), perpetuated justifiable scepticism about the benefits and impacts of computerisation (Brynjolfsson and Hitt, 1998). Solow (1987:36) summarised it best when he wrote, "we see the computer age everywhere except in the productivity statistics". This position has since then changed, evidenced by the realisation that ICTs had contributed as much as 59% of productivity growth within the United States as a whole during the second half of the 1990s (Jorgenson et al., 2008). Before this review of economic impacts, and despite the lack of macroeconomic evidence of impacts during this period, research conducted at the level of firms and individual enterprises were suggesting opposite conclusions quite early on yet on another scale. Firm level studies were showing that investing in IT brought substantial returns and that contrary to the productivity paradox; ICTs had significant impacts (Brynjolfsson and Hitt, 1998). Research sought to differentiate findings and discover if the

technology itself was responsible for these productivity gains and uncovered that in practice, usage of IT was associated with broader reforms which were themselves facilitated by the new technologies, such as "self-directed work teams" and "greater levels of individual decision authority"; ICTs were not only changing the way people accomplished work but they were affecting the very organisational structure of firms (ibid: 8). Furthermore, what was found is that the new technologies did not stimulate faster growth for the economy as a whole during this initial period but rather they benefitted specifically those who were making use of the tools, their manufacturers and the IT industry itself thereby displacing profit making within the economy and not adding significantly to overall growth (Jorgenson and Stiroh, 1999). As Rodríguez and Wilson (2000: 2) note, "Although these new technologies appear to be improving economic performance and welfare among the user population, the link between ICTs and society-wide economic progress has been more elusive". The authors report that during this period the spread of ICTs within the United States and the United Kingdom actually contributed to the increase of income inequality within these countries as the impacts of the new technologies benefitted the few who made use of them; helping the skilled and not the unskilled within those economies. Recalling Sen's work on choice of technology and concerns for technology-led displacement, Rodríguez and Wilson hypothesise that "The people who are displaced by machines create a new mass of unemployed that depresses existing wages" (ibid: 33), therefore risking, in the context of development, to exacerbate even further already high levels of income inequality in developing countries. Mansell (2009: 8) confirms the occurrence of this unfortunate outcome and attributes it to the "obsolescence of skills and qualifications, the dislocation of peoples, and considerable wealth creation for some but not for others". This is rightly an important consideration as the distribution of access and skills to use ICTs within an economy "permit those who have them to

participate more effectively in the global information economy and society, access opportunities to conduct business or more simply just to engage and transact more efficiently" (Schmidt and Stork, 2008: 5). Exploring the impacts of ICTs in development, Schmidt and Stork's survey of "e-skills" within 17 African countries reveal that the majority of respondents who do not make use of ICTs in more than 50 per cent of countries surveyed most often cite "lack of skills" as the primary reason for not making use of such technologies (ibid).

At this point in time, a growing body of research suggests that the positive impacts of ICTs on economic growth can now be observed at the macroeconomic level despite difficulties at identifying evidence of their spill-over effects (van Ark et al., 2003; Draca et al., 2006; Rezaian, 2006). These technologies were always seen as catalyst for broader economic impacts despite the lack of evidence; "ICTs are 'synergetic' technologies and their growth therefore leads to growth in other sectors of the economy" (Hamelink, 1999: 32). Comparisons of economic growth in the United States and Europe conclude that higher productivity growth in the U.S. is attributable to the "dual effects from a larger ICT producing sector and faster growth in services industries that make extensive use of ICT" making the "slower diffusion of ICT… the principal factor in explaining the lower European productivity growth" (van Ark et al., 2003: 2). The authors therefore suggest causality between ICTs and economic growth. More recent research on the linkages between ICTs and organisational structures confirm that these tools and techniques can have greater impact when combined to reforms and restructuring of work processes that in turn make use of the added capabilities offered by ICTs (Draca et al., 2006), and that these benefits can be furthermore amplified by the new opportunities of Web 2.0[3] (Hamel, 2007). "It is not

[3] Web 2.0 is a concept that differentiates between the static nature of first generation websites, and their typically one-way approach to communication, and second generation web applications and processes that include interactive tools that allow online collaboration. Gary Hamel's ground

electricity or ICTs as such that make the (bulk) impact on economy and society but how they are used to transform organization, process and behaviours" (OECD, 2008: 7). For example, the telecommunications sector is an important area of foreign investment in many developing countries as it has been in the developed world and is a source of significant innovation and entrepreneurial spirit that has lead in many cases to important increases in national incomes. Research demonstrates that investments in ICTs during the 1990s were responsible for more than 50 per cent of increases in productivity in the United States and Australia but that the broader economic outcomes of introducing ICTs, the "spillovers", have statistically been most significant as a total share of economic activity for low-income countries than high-income countries (Mann, 2003). The poor therefore risk benefiting the most from investments in ICTs coupled to national policies that promote their accessibility and use. The cases of Singapore and Korea demonstrate some of the important impacts that effective policies on technology can bring to an economy and the income levels of its people (Warschauer, 2004). Malaysia, with its Multimedia Super Corridor launched in 1996, is a great example of a national strategy that has successfully transformed its economy from predominantly manufacturing activities into a world leader in production of ICTs and related services. Initial investments by the government with well defined policies and legal guarantees that are coupled to changes in pedagogical curriculum to guarantee a future supply of labour have attracted substantial foreign investment and have situated the country amongst the powerhouses of the knowledge economy (Uimonen, 2003).

Evidence from Best and Kenny (2009) suggests that ICTs can stimulate private sector growth in developing countries and increase incomes of the poor. They report that the introduction and

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breaking work on the future of management (2007: 251) understands successful management and productivity to be intimately tied to this new generation of online tools which can aggregate "effort through pervasive, real-time connectivity".

use of these technologies have resulted in significant macro-level impacts on national economies by increasing the potential for competitiveness of national enterprises. It has been observed that in most countries it is the private sector that is making the most use of ICTs and by consequence growing from its benefits (Borge, 2006). To serve the aims of ICT4D and stimulate these outcomes, the gaps that exist between developed and developing countries need to be reduced significantly. Studies demonstrate that there is a positive statistical correlation between the prevalence of telephone and Internet access and entrepreneurship, business development and consequently incomes of the poor (Forestier et al., 2002). Additionally, ICTs such as broadband Internet continue to have important impacts on productivity and economic growth even in the most advanced economies. It is estimated that this is the case for the United States and North European OECD countries where additional investments in broadband have stimulated as much as 10 per cent of recent productivity growth as a result of the broader benefits of the technology (LECG, 2009).

At a micro-level, documented examples of how ICTs impact the incomes of the poor include the case of LifeLines India. This initiative represents an approach to development that seeks to increase the information resources of rural farmers, in this case in India, to help them increase their incomes and fight poverty through increased agricultural productivity. OneWorld South Asia setup the telephone service that connects individuals and collectives of farmers in more than 2000 villages where access to the Internet due is limited due to resource constraints and high illiteracy rates. Through the LifeLines system they are able to receive expert advice on farming and husbandry techniques which improve the success of their crops and the health of their animals. The system is rather simple. A farmer dials in to the network and records a question which is then answered and sent back to them within 24 hours via a recorded message. The

system's database of more than 145,000 answers is first searched to see if the answer has been answered in the past. Only if staff is not able to locate the appropriate response will they seek the support of an expert to answer the query, which are consequently recorded in the database for the ongoing benefit of the community of users. The service, which costs approximately 0.12 USD per question, is a very small investment that demonstrates in many cases increases of 25-150 per cent in profits to farmers as a result of higher yields and higher quality products (Gabriel and Godfrey, 2009). This system is a great example of an innovative use of technology coupled to a business model that serves the development needs of the poor. The e-Choupal model, also in India, is another approach to maximise revenues of rural farmers by giving them access to a network of markets and buyers for their products. The objective in this model is to make a direct connection between farmers and markets. The network reaches more than a million farmers in 11,000 villages. When making use of the network, financial gains to farmers are reported to average 2.5 per cent above those of traditional systems. Another benefit of the e-Choupal model is that it functions like a telecentre and so can be a place of assembly for farmers who are then able to purchase supplies collectively therefore giving them bargaining power when negotiating with seed, fertiliser and equipment vendors. Conducting business as small groups, in a cooperative fashion, the participating farmers are able to purchase necessary supplies in larger quantities therefore reducing their costs (Wattegama, 2005).

Making information and knowledge available to the poor through ICTs that require very little skills and resources beyond what is already at their disposition is very often an effective approach to ICT4D (Unwin, 2009b). In economic terms, it is the use of ICTs in pursuing growth of incomes for the poor that make these tools powerful contributors to development (Mann, 2003). The Village Phone project of Grameen Telecom is another example of highly successful

use of ICTs. In this case, mobile phones not only empower women within their communities but increase their incomes by turning the ownership of a mobile phone into a business model. This model was designed as a strategy to fight poverty through livelihoods and has successfully created an income for more than 360,000 people in rural villages of Bangladesh. The model has been so successful that it is being replicated in more than 30 countries across Latin America, Northern and sub-Saharan Africa, the Middle East and Southeast Asia (Grameen Foundation, 2010). Mobile phones in developing countries are in many contexts new channels of communication and resource allocation that offer opportunities to shift social roles, hierarchies and impact gender relations within communities by giving individuals access to information and resources such as mobile remittances (Hamel, 2009). Microfinancing is very often tied to the use of ICTs as tools to build capabilities and contribute to the fight against poverty (Attali, 2004). The recent emergence of mobile banking is acclaimed as the future of banking in the developing world bringing banking services to the masses of rural poor who live and work beyond the reach of official banking institutions (Amin, 2007). Through mobile transaction services, money can now be sent to and from all corners of the world and also be used to do payments thereby reducing the need for expensive travelling to urban centres and reducing the costs of wiring money. Mobile banking has tremendous potential in the developing world and could "prove to be particularly valuable and pro-poor because basic financial services including secure savings accounts, non-usurious credit opportunities, currency management and fund transfers are critical to many low-income communities" (Best and Kenny, 2009: 191). Service delivery for the poor, or bottom of the pyramid business models, are having tremendous impacts on the lives of the poor in the developing world (see Scott et al., 2004 and Prahalad, 2004). With ICT investments representing 194 billion USD of foreign direct investments in developing countries between

1990 and 2003 the sector is bound for continued growth and deepening economic impact (Guislain and Zhen-Wei Qiang, 2006). These trends are promising since already, for many of users especially in developing countries, mobile phones have become the most important ICT that is significantly bridging the digital divide (Rashid and Diga, 2008).

Enhancing Capabilities for Human Development

As we have seen from the data on accessibility to ICTs around the globe, a large segment of the world's population does not make use of ICTs in their day to day life, though we can hardly say the same thing of the impacts of ICTs to people's lives worldwide. The ubiquitous impact of ICTs can be demonstrated through the interconnected financial markets of the world and the trade of goods across all continents. Information and purchases that exist within global markets powered by ICTs can furthermore impact supply and demand of products on such large scales that shifting prices, such as that of food staples, can be felt by people in the least wired villages of the developing world (UNCTAD, 2008). ICTs and their networks have become the channels of power and financial resources of the world and marginalisation from these networks is perhaps the most damaging form of exclusion for any individual or community today (Castells, 2000; DOT Force, 2001; Warschauer, 2004; Unwin, 2009f). Connecting people to these processes and opportunities can turn ICTs into powerful enhancers of capabilities for human development. Applied improperly, they can also deepen inequality. The difference between the two is up to us, governments, the private sector and all development stakeholders. "Whether the ICT-potential will be successfully exploited in support of human development depends much more on the institutional organization of the technology than on its technical features per se" (Hamelink, 1999: 42). National ICT strategies are essential in meeting these challenges.

Governments must regulate investments and policies applied to telecommunication service providers through collaboration between the private and public sectors. "Because each country's resources, capabilities, and development priorities differ, national ICT strategies need to be tailored to specific technological strengths and social and economic development priorities" (Mansell and Wehn, 1998). National strategies should also promote collaboration and involvement of stakeholders and they should contain clear development objectives and targets (Hilbert and Katz, 2003; Weigel and Waldburger, 2003). Participation should be at the centre of the process. Such an approach increases the likelihood that development outcomes will be sustainable over time since there is a sense of local ownership of both the process and the objectives of development (Kleine, 2009). From a technical perspective, McQuerry (2004) explores the deployment of ICTs and their infrastructure and emphasizes the importance of being able to answer a set of questions that seek to map the terrain and the resources needed to meet development objectives. The environment in which these technologies will be used, the required distance of transmission, the level of security that must be guaranteed, the potential future needs and requirements of the system, and the regulations that are in place all determine the options available in any given context and are all important questions whose answers will have fundamental impacts on the potential level of access and diffusion of ICTs. We have also seen that these challenges get increasingly difficult in many rural areas of developing countries that are also struggling with low literacy rates, lack of basic rights, gender imbalances, and severe financial and resource restrictions.

As DAC (2005) remarks, markets alone are most of the time insufficient in delivering ICTs to the poor in developing countries. In overcoming these challenges, collaboration with the private sector is necessary. Partnerships can attract financing and investment into ICTs for

human development especially where governments regulate the market in ways that promote competition and benefit the poor. In its strategy for donors, DAC (2005: 27) states,

> "The development of expertise and technological innovation in developing countries cannot be left to the market alone. It is up to the government and NGOs to ensure that the poor also benefit from ICTs wherever possible. This can be done by formulating policies with stakeholders that specifically focus on the interests of the poor, by encouraging network operators to channel some of their investments towards less commercially attractive regions, by encouraging and co-financing ICT applications that will directly benefit the poor, such as information points in local community centres, and by investing in ICT applications in the public sector – for example, in education and health care."

The importance of regulating telecommunications cannot be overstated. What is meant exactly by regulation and the models for effective regulation are up for debate but the World Bank's Intven and McCarthy (2000) recommend that effective regulation achieves several essential ends; it harmonizes national markets with regional and ultimately global standards, it allows competition, it regulates by principle and with careful evaluation, it establishes operational efficiencies that benefit from lessons learned in the field and minimizes regulatory interventions once the system is in place. Regulation, such as this, is proven to stimulate growth of this sector and contribute to national incomes (World Bank, 2005). Poor regulation unfortunately thwarts many potential benefits of ICTs in developing countries, especially where the push for privatisation of telecommunications services does not lead to market liberalisation. Without proper regulation, privatization can usurp liberalization as investors seek to protect their investments from competition. The International Telecommunications Union (ITU) advocates in favour of liberalisation of telecommunications infrastructure and services as the best means to

lower costs and promote investments in this sector which will in turn incite growth. For example, "without greater demand, the market for broadband services in many developing countries will remain stunted, crippling the broad-based social and economic growth that comes from joining the information society" (ITU, 2008: 18). Monopolies on infrastructure and service delivery of ICTs keep prices in many developing countries far above the means of local users therefore limiting their demand and the potential impacts of these tools. The case of Timor-Leste, where a national service provider maintains service costs that are far beyond the budgets of local communities and organisations, demonstrates how the privatisation of telecommunications in the developing world is liable of being monopolised by private investors to the demise of their potential for human development. Hamel (forthcoming) demonstrates that contrasting the telecommunications sectors of Papua New Guinea, Indonesia and the Philippines, which are all at least partly liberalised and allow competition in one or more of its ICT sectors, to that of Timor-Leste, which is monopolised by a single service provider whose service costs are essentially unchallenged by competitors, shows the importance of liberalisation of service delivery and backbone connectivity of ICTs. Guida and Crow (2009) report a similar situation in Ethiopia where the deployment of ICT infrastructure and services is overly subject to the interests of the service provider that holds monopoly rights over the market. Avoiding and rectifying these market barriers should be a priority in developing countries where slight increases in costs can be the defining element that determines the ultimate capability of people and organisations to use ICTs. As Mann (2003: 70) reports, "higher telecommunications costs inhibit Internet use… Sadly, the relationship between costs and usage is most apparent in the poorest countries, where costs are exorbitant and usage rates are lowest." Governments and national regulatory authorities should defend the development objective of establishing universal

access to ICTs, especially in contexts where the private sector cannot guarantee it and where governments have made a pledge to do so[4]. Ultimately the goal of ICT4D should be to make life simpler, not more expensive. This issue is of utmost importance to development as was reported throughout this paper. Allowing competition and reducing the costs of ICTs can mean freeing up important national resources needed for other development interventions, as is the case of using ICTs in health (UNDESA-GAID, 2009).

As the cases of many developing countries demonstrate, pushing for privatisation in hope of attracting private investments into the telecommunications sector will not suffice. Privatisation leading to the creation of private monopolies is fundamentally different than promoting liberalisation of industries managed by the state. This short sighted approach observable in South Africa (Horwitz and Currie, 2007), Ethiopia (Guida and Crow, 2009) and Timor-Leste (Hamel, forthcoming) results in drastic and unnecessary rises in service costs which benefit wealthy investors at the cost of local communities and national development objectives. ITU (2009c) reports that in 2008, more than 30 per cent of countries around the world are restrained by a monopoly on local services, domestic and international fixed-line long distance calling; around 20 per cent for local wireless, leased lines, paging, fixed satellites and international gateways; above 13 per cent for data transfer, direct subscriber lines; and around 10 per cent for very-small aperture satellites, wireless broadband internet, mobile phone services, and cable television. In total, 81 countries have a monopoly, either private or public, over one or more of the aspects of their national ICT infrastructure and service delivery. Using the HDI as a reference, they are all developing countries with the exceptions of Andorra, Australia, Brunei Darussalam, Cyprus, Israel, Kuwait, Qatar and Liechtenstein. Such settings make it difficult to establish proper

[4] See WSIS documentation for the list of 174 countries that have endorsed the Tunis Commitment: http://www.itu.int/cgi-bin/htsh/wsis/wsis05/edrs.stat.byentity.admin.list.

national telecommunications strategies that can deliver on the promises of ICT4D. Contrastingly, in Liberia, where in a span of three years following the creation of a national strategy to manage the telecommunications sector, penetration rates for mobile phones reached 12-13 per cent of the total population in 2006, an incredible increase from 0.06 per cent in 2003 (Best et a., 2007).

Research shows that ICT4D and the human development and capabilities approach can be complimentary. With potential contributions to health, education, income, empowerment and participation, ICTs can enhance capabilities for human development especially in competitive markets and where policies and investments are made to benefit the poor. Moving forward, the agenda of the development community ought to be to overcome the range of barriers outlined in this paper. Importantly, it is hoped that readers understand that the use and importance of technology is not determined by capabilities that are limited to the developed world. Most can learn to use ICTs when barriers have been lowered and divides have been bridged; technology is not synonymous with any particular part of the world or culture. Considering the use of ICTs by the poor in rural villages of developing countries as many examples in this paper highlight makes this fact particularly visible. These instances demonstrate, as Appadurai (1996) suggests, that modernity is truly at large. It is consequently possible for technology to be used to unlock the potentials for human development that is always lurking behind the hidden opportunities that manifest within peoples' lives. To achieve this, the international community in tandem with local governments and the private sector ought to assure that the use of ICTs is participative, equitable, empowering and sustainable for their benefits to have a chance at impacting the lives of the poor. Despite many advocates' reduction of ICT4D to technology and knowledge transfers from a developed "us" to an under-developed "them", effective use of ICTs in development seeks to understand local concerns and realities and values the input and participation of the poor

(Robinson, 2006). Research shows that these tools and techniques can have positive impacts on increasing the participation of stakeholders in debates concerning poverty and development, thereby making development more relevant to their lives and meeting important human development objectives (Lekoko and Morolong, 2006). The examples contained in this paper collectively point to what Unwin (2009f) considers the principles of ICT4D. Firstly, the use of ICTs in development should rely on needs assessments. There should be mapping exercises that document the context and existing infrastructure, identifying appropriate technology and planning for accessibility and sustainability. Secondly, policy makers and practitioners should promote the engagement of stakeholders and assure ongoing monitoring and evaluation. It is important to understand that in the use of ICTs in development, the goal should not be to install technology; the goal must be human development. This means empowering the poor through participation and increased freedom in order to increase opportunities for well-being.

Making ICTs Accessible

Statistically, universal access and use of ICTs is very rare if one includes the Internet, even in the most developed countries (ITU, 2009c). Gender, ethnicity, age, income, geography and levels of freedoms are all significant dimensions that give rise to inequality of access and use of ICTs on the ground (Norris, 2001). Furthermore, research shows that across the world the distribution of ICT users is highly impacted by repeated demographic patterns that affect the general profile of users which are most likely to be young educated adults who have access to a disposable income (Guida and Crow, 2009). These characteristics are significant in determining the likelihood of access to ICTs but they do not dictate any inherent ability to use or learn to use these tools (Mitra, 2009). From an infrastructure and network perspective, we must also consider the

presence of electricity, service providers, telecommunications regulation, national legislation, equipment and technicians as potential obstacles to the use of ICTs at the national level (Hamel, forth coming). It is the totality of these barriers that make up the digital divide. As a concept, the digital divide is "a broad allusion to the skewed distribution in the production, access, and consumption of ICTs as mechanisms for social and economic development between and within countries" (Isaacs, 2006: 212). The reasons for gaps across and within countries are many as stated above but what is important to understand is that the digital divide is considered by most as a social and political problem and not one of technology per se (Weigel and Waldburger, 2003; Burtseva et al., 2006). "From a policy standpoint, the goal of using ICT with marginalized groups is not to overcome a digital divide but rather to further a process of social inclusion" (Warschauer, 2004: 8); inclusion into the wider world of the Information Age and the important benefits that ICTs may bring to many dimensions of human development. In many ways, ICT4D relies on solving a gamut of "soft issues" in order to reach the poor (Cecchini, 2006), and address their needs and desires through enhanced capabilities. As capability enhancers, ICTs can be said to potentially create and strengthen both capabilities and functionings depending on their value to people and their use. Mansell and Wehn (2008: 10) write,

> "The emergence of new capabilities is closely linked to the progress of scientific and technical innovations… Those with access to these innovations – and those who have the capacity to absorb them and use them – will have opportunities to reap social and economic advantages. Those without access and the appropriate capabilities risk being marginalised in the 'knowledge societies' of the future."

There are countless options when it comes to the use of ICTs in development and the strategies to implement them. Although the notion of ICT4D is often equated with access to

mobiles phones and the Internet, it can mean much more. Consider weather monitoring systems, emergency response systems, digital financial transactions, electronic procurement systems, geo-referenced information systems, satellite imagery to manage environmental resources and information processing systems; these are all techniques powered by ICTs. As such, these tools and techniques all have unique costs and benefits for development (Gasco-Hernandez et al., 2006). Experience in ICT4D suggests that their applicability in development and their potential to positively contribute to the life of the poor necessarily entail that the use of technology in achieving human development objectives needs to be designed based on assessments of the goals of the target community. Careful analysis of costs and available resources, assessment of existing infrastructure, presence of connectivity and prevalence of access to various technologies, presence of a regulatory environment that might prohibit or facilitate various options, and mapping of existing capabilities and learning needs of users all need to be taken into consideration. Furthermore, these assessments should be done locally. As Unwin (2009e: 119) remarks, "Far too often, externally generated solutions have been imposed without sufficient attention being paid to these crucial factors, and this is one of the main reasons why so many ICT4D projects have failed to deliver sustainable outcomes." Respecting this approach will greatly enhance the likelihood of success and the potential for ICTs to benefit human development.

Furthermore, the ideal solution in the use of ICTs to enhance capabilities for human development are often not the most advanced and latest technologies but rather the most adaptable and supported tools that are valued by the users. Experiences from India demonstrate that, "even the least advanced robust technology can do wonders with proper participation"

(Wattegama, 2005: 10). This can also help avoid squandering valuable development resources since,

> "ICTs are often a financial drain on communities until there is sufficient wealth generated for them to provide enough profit for their continued use. …ICT4D initiatives are not sustainable or effective unless the technologies embedded within them deliver on the demand of users in appropriate ways. There is little point simply in introducing the technologies if users cannot see any economic, social or political benefit or in paying for them. …One of the most important challenges facing those implementing ICT4D initiatives is therefore to identify how best to respond to the needs of the poor" (Unwin, 2009e: 76).

Many would wonder if such complex tools as ICTs are appropriate in poor communities where people very often have received only elementary levels of formal education. Many would consider advanced levels of studies vital to the use of ICTs. Quite to the contrary, experiments demonstrate that the most basic forms of literacy can be sufficient in making use of such technologies when properly designed (Lekoko and Morolong, 2006). Those who are sceptical of this view can consider the creativity and ingenuity of the rural poor in developing countries as demonstrated by the “hole in the wall” experiment. This project, conducted over a period of five years between 1999 and 2004 in 22 villages of India reveals that despite the statistical odds of having access to ICTs, an estimated total of 40,000 poor children demonstrated that they could develop the capabilities needed to use the computer and surf the Web on their own, without any investment into ICTs except the installation of a computer in a hole in a wall. Only the mouse and touch sensitive screens were available for users to interact with the computers and there were no attendants to explain what the computers did or how to use them. Gathering around the

screens mounted like windows to the network society, children simply learned and taught each other how to use the computers, progressively discovering the paint and draw application, games and all sorts of Internet tools. As Mitra (2009: 340) writes, "Their ability to do so seems to be independent of variables such as educational background, literacy levels, gender or socio-economic level." This example may not exhibit the features of a successful ICT4D initiative or development strategy as described in this paper and it may not be seen as an example of effective education either (Warschauer, 2004), but it does contribute to demonstrate humanity's inherent capabilities and deep ingenuity.

Of particular importance for development is the potential of localised software that is adapted to the particular human development needs and capabilities of the poor. The computer itself is only a machine with no inherent social value but it can become a powerful tool for development if it is combined with applications that are able to assist the development process of individuals and communities (Unwin, 2009e). Another challenge is achieving financial sustainability of ICT4D strategies, especially in rural areas where the costs of infrastructure, communications and electricity add to the risk that ICTs become financial burdens instead of tools for development (Proenza et al., 2001). These are crucial considerations since behind the statistics on Internet and mobile penetration, and behind the theories of ICT4D, there is a troubling trend; most monitoring and evaluation exercises in the field observe that ICT-led development strategies have commonly been financially unsustainable and have performed far below expectations. There are many case studies that document the brightest examples of success, but these seem to be exceptions more so than the norm. This is especially true in rural areas of the developing world (Day and Greenwood, 2009) and particularly in Africa (Unwin, 2009e). A portion of the literature on the subject agrees that despite all the theory and the case studies of success, there are still too many

obstacles in the field, especially in rural areas, for building "appropriate ICT infrastructure, human resources, private enterprises, and institutional capacity to respond to these needs", especially in sub-Saharan countries (Rezanian, 2006: 51). Furthermore, ICT4D's prospects for widespread social benefits are anecdotal at best, as the case of India demonstrates. Largely fuelled by the returning diaspora and their networks worldwide, the IT sector of the country has flourished and is now recognised as one of the important centres of innovation around the world (Hamel, 2009), but despite the fame of its burgeoning software industry and outsourcing services, the success of ICTs in India have so far unfortunately failed to benefit the population as a whole (Alampay, 2006). Notwithstanding the promising use and increasingly complex range of development initiatives making use of ICTs, such as the myriad telecentres of the world which focus on solving local and regional development obstacles through innovative and practical applications of technology and service delivery (Surman, 2009), many uses of ICTs in development are dependent on continued financial support and subsidisation in order to remain operative (Unwin, 2009d). A fundamental problem in the application of ICTs is apparently the domination of the field by technologists approaching the implementation of the tools and techniques in purely technological terms, with insufficient attention to local capacities and the diversity encountered in the field, which can make it or break it in developing countries (Heeks, 2009). These obstacles which serve as barriers to the advancement of human development need to be overcome. As Gasco-Hernandez et al. (2006: xv) write, "We do not eat information, but we can use information to grow more food and learn better nutrition habits. And in some circumstances, like natural disasters, the AIDS epidemic, or simply being in the face of rough seas (for fishermen), information simply saves lives."

As a response to the material reviewed in this paper, several policy recommendations can be

outlined that can positively contribute to lowering barriers to the use of ICTs and increase their accessibility and therefore impact for development. In meeting the challenges of adapting ICTs to enhance capabilities for human development, policy makers can ensure that their national telecommunications market is open to competition and is aligned with regional and global standards. As reviewed, research demonstrates that liberalisation of telecommunications tends to reduce prices and consequently increase usage. Policy makers can also ensure that the necessary infrastructure is in place to allow ICTs to be deployed. This includes electrification, mobile network coverage, public access points (especially affordable or free access such as in telecentres) and sufficient Internet connectivity for fast and efficient use. Investments in education and literacy campaigns can also be necessary. Policy makers can also promote the use of ICTs by being users themselves and making ICTs an integral part of the governance structure of the country so that general use of the technologies is promoted. This includes creating opportunities for citizen participation through ICTs and promoting transparency of government activities through ICTs. Finally, policy makers can ensure that participation in the networked society is safe by defending freedom of expression; empowering users to make use of ICTs in such a way that does not result in backlash and censorship can greatly impact the development potential of these tools. Freedom of virtual assembly is as important to political participation today as the freedom of physical assembly and expression have been to the historical development of democratic states (Murray, 2010).

Conclusion

This paper looked at the human development dimensions of empowerment, participation, health, education and income to see if ICTs could have positive impacts on the lives of the poor. It asked

difficult questions that sought to establish whether or not ICTs ought to be included in the development strategies of poor countries despite their high costs and the challenges of measuring with precision the specific contributions that these technologies have on human development. The paper also explored the necessary involvement of governments and private sector investments in ICTs as necessary conditions for their use in developing countries. The paper explored these themes through careful review of literature and research in all of these dimensions along with a review of trends on ICT diffusion, which shows impressive progress in the use of ICTs amongst developing countries and gradual convergence with developed countries especially in the use of mobile phones. A recurrent observation in the literature surveyed in this paper is the important realisation that ICTs alone cannot improve peoples' lives; the use of ICTs needs to occur within broader strategies that are tailored to make the most use of these tools and techniques in order to reap their potential benefits for human development. ICT4D therefore only represents a potential for increasing opportunities and capabilities through technology, which can also increase inequality around the world and benefit only those that are able to gain from the new opportunities that ICTs facilitate if applied with disregard for the interests of the poor (Gasco-Hernandez et al., 2006). As demonstrated by examples of short-sighted and repressive policies above, it is vital that international institutions and policy makers continue to promote the goals set out at WSIS if their objectives truly are to make ICTs tools to enhance human development. It is also important that the rights and sovereignty of states are not used to construct national policies that limit accessibility to the Internet (MacLean, 2005). Without an un-bending promise to uphold and defend freedom of expression and open access to ICTs, members of WSIS will be unable to effectively promote their agreed international agenda of development through increased global communication and deployment of technology. The

applicability of these tools and techniques must furthermore be designed and understood within their particular context of use. New technologies displace older and alternative ways of doing things. Using ICTs for human development may entail the displacement of valued social systems, communication and production models that are not easily included into new structures that revolve around modern technology. ICT4D advocates must therefore always be cognisant of the tradeoffs and potential displacements that can arise from the development of such new tools and techniques, especially in developing countries. Review of ICT4D projects have taught researchers that ICTs have much greater chances of successfully tackling development barriers in where practitioners conduct thorough assessments and evaluations of both the envisioned problem and proposed solution (Tongia, 2006). Making human development the goal of ICT4D is therefore a daunting challenge that requires participative and multidisciplinary reflection, continued research and evaluation, and meticulous preparation on the ground in order to enhance its potential for human flourishing. As evidence of best practices continues to surface, allowing practitioners and policy makers to draft effective development strategies, it is the conclusion of this paper that using ICTs to enhance human development is increasingly possible but needs to be done with awareness of their potential downsides and tradeoffs and the need for significant financial resources. People-centred strategies and technologies are needed to make ICT4D a model for people-centred development.

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